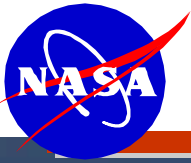


# Improvements in Process Control for the Space Shuttle Program

*Space Shuttle Program  
Technical Program Manager's Review  
November 8-9, 2000*

**Joyce Rozewski**  
NASA Space Shuttle Program Office



## Background

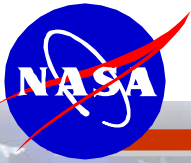
Are you ready  
for us to go?



- Process control problems were causing delays and mission impacts to Shuttle Program
  - Hatch latch actuator problem prevents EVA, STS-80
  - Contaminated cleaning cloth causes extensive testing and analysis before launch of STS-103

### Shuttle Program Manager Concern

- Safety Risk
- Need to Improve Process Control across SSP



# Government-Industry Team Formed

- **Process Control Focus Group:**
  - Chartered by Shuttle Program Manager, October 1999
- **Membership:**

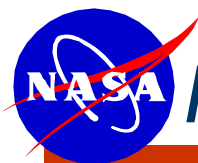
## **NASA Centers**

- JSC, Lead
- MSFC
- KSC

## **– United Space Alliance**

- Rocketdyne
- Lockheed Martin
- Thiokol
- Hamilton Sundstrand
- Pratt Whitney





# PCFG Team Members



## Joyce Rozewski

Manager, JSC Resident Office NASA

## John J. DeGiovanni

Director, SSME Program Field  
Operations, Process and S&MA  
Boeing-Rocketdyne

## Shailesh A. Parikh

Manager, Procurement Quality  
Lockheed Martin

## Keith Foulger

Manager, Configuration & System  
Management  
Thiokol Propulsion

## Dan Specksgoor

Manager, SSME-AT Production & Flight  
Support Program  
Pratt & Whitney

## Ron J. Lang

Director, Procurement Quality Assurance  
United Space Alliance

## Tammi Belt

Project Leader, Process Integrity  
Procurement Quality Assurance  
United Space Alliance

## Mike Gemme

Chief of Process Engineering  
Hamilton-Sundstrand

## Lionel Ribeiro

Manager, Procedures & Training  
Hamilton-Sundstrand

## Bruce Lockley

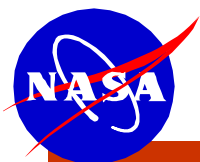
Logistics Operations Lead  
NASA KSC

## Mike Smiles

Deputy Manager, Transportation  
Assurance Dept., S &MA Office  
NASA, MSFC

## Tom Malatesta

SR&QA Manager, Huntington Beach  
Res. Office  
NASA JSC



## *Root Causes Determined*

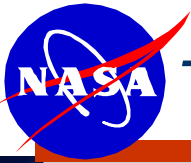
### *➤ Changes at Suppliers Not Adequately Assessed and Technically Verified*

- ◆ Seemingly minor changes to “noncritical” processes causing significant problems
- ◆ Existing Quality Systems, ISO 9000, contractual requirements inadequate to protect against some changes
- ◆ Rigorous control over critical processes

### **Contributing Factors**

- Process drift over time
- Unreported, well-intentioned process improvements
- Changes caused by environmental regulations
- Business realignments
- Aging program/Loss of corporate knowledge





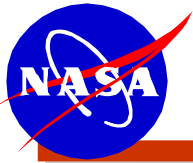
# Team Developed Solutions



- Determine **best practices** for process control used across program
- Create program process control **standards** from these best practices
- Communicate process control **lessons learned** across program elements
- Increase **awareness** of importance of process control across all levels of Shuttle Program

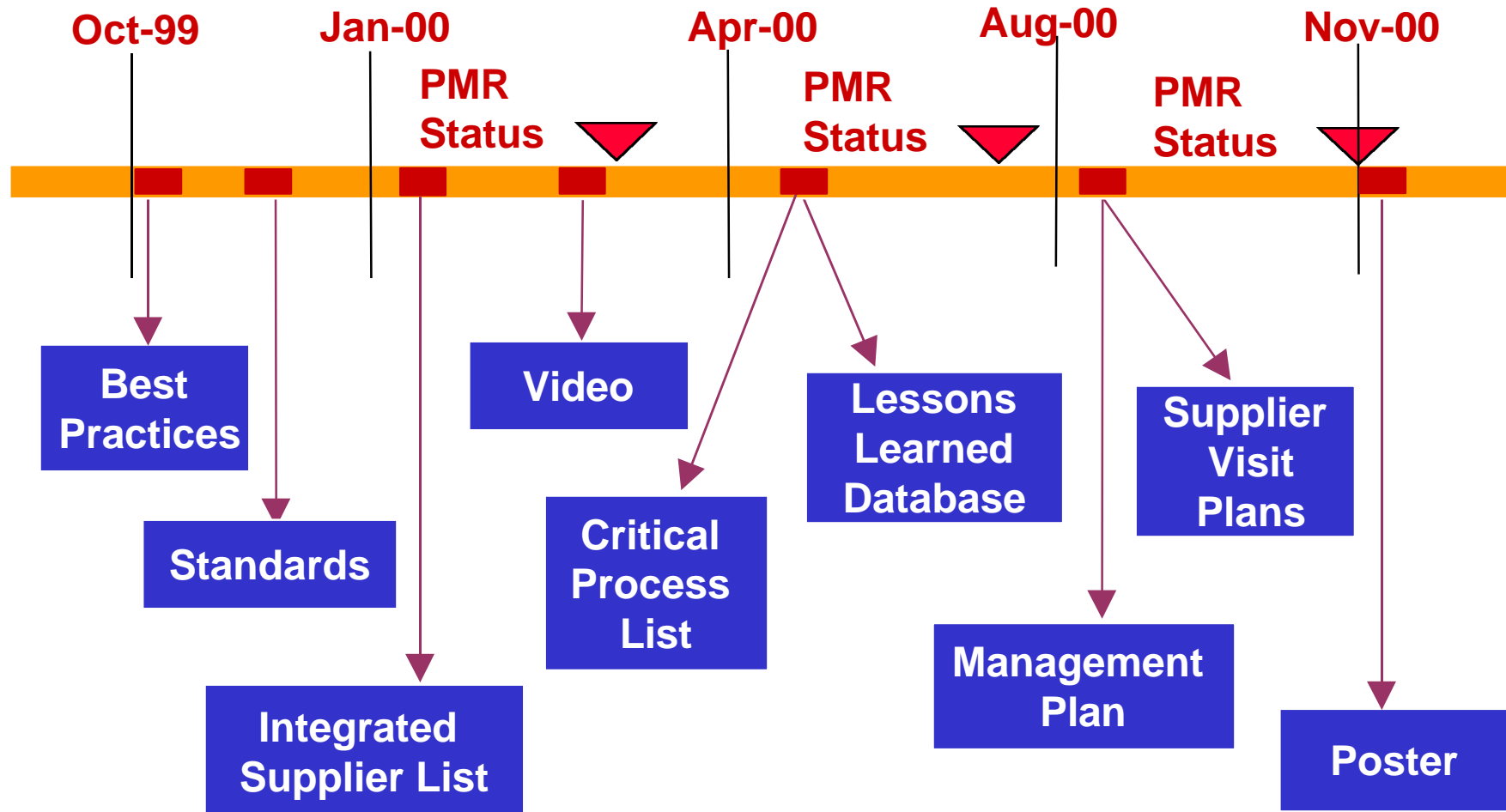
## CHALLENGE:

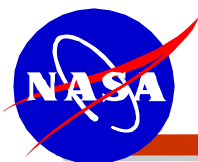
- ✓ Large Supplier Base - >850 Active Suppliers of Flight Hardware Across 50 States
- ✓ Thousands more 2<sup>nd</sup> and 3<sup>rd</sup> Tier Suppliers



# Schedule and Products

**PROCESS CONTROL**  
Mission Success Depends On You

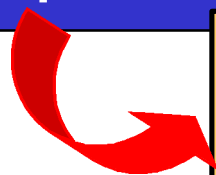




# *Process Control Standards*

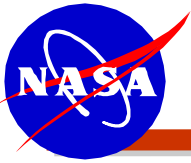


- Provide for early detection of process variability and uncoordinated changes
- Eliminate process “creep”
- Understand and mitigate process risks
- Identify critical characteristics and processes to control
- Enforce personal accountability to perform exactly per written procedures
- Promote awareness of process control
- Identify and evaluate changes to equipment and environment
- Capture and maintain process knowledge and skills.



**Process Control Management Plan  
Approved by All Prime Contractors**





# Supplier Awareness



## *Video*

**Widespread Distribution – To All  
Major Suppliers This Year**

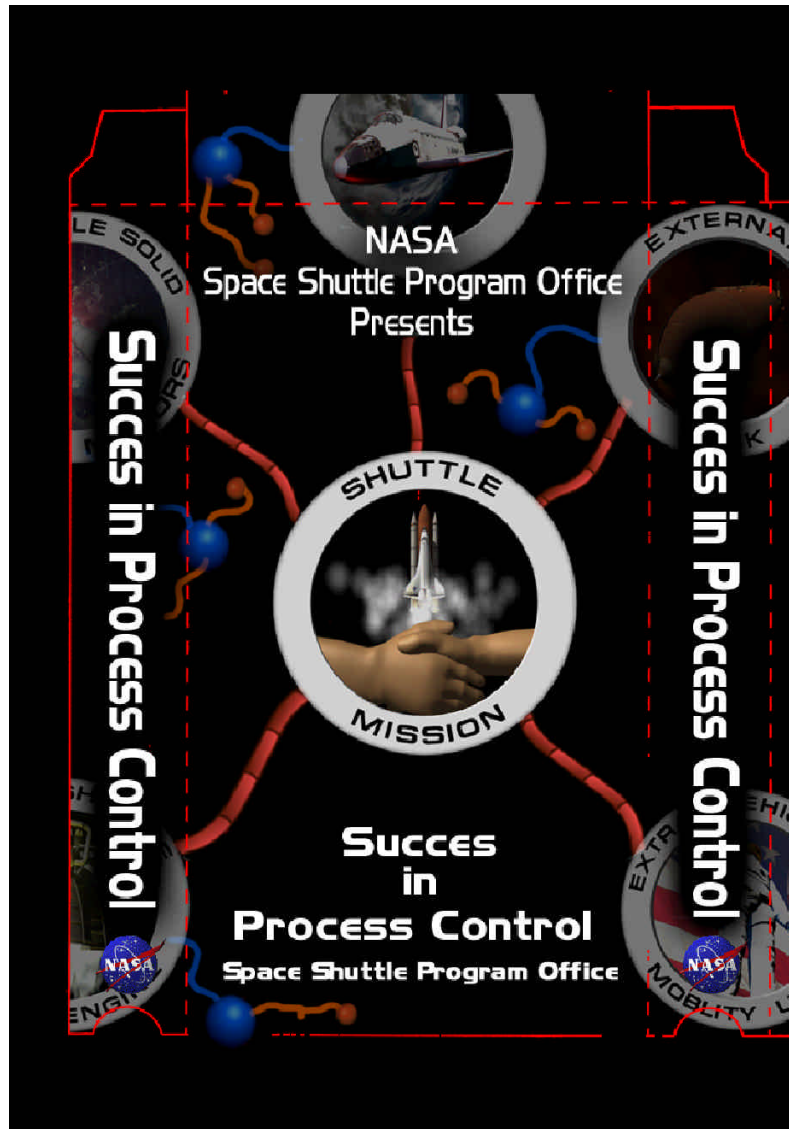
**Very Well Received – Strong  
Feedback**

**Follow on video: Process Creep**

## *Supplier Visits and Symposiums*

**Joint Visits for Common  
Suppliers**

**Astronaut Support and Space  
Flight Awareness**





# Posters and Brochures



## ***Posters***

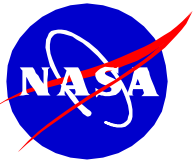
**5500 Posters printed in two sizes**

**Distribution to all major suppliers with video**

**Follow on poster to accompany process creep video**

## ***Supplier Brochures***

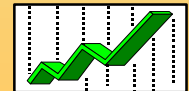
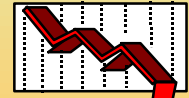
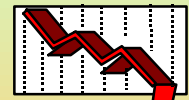
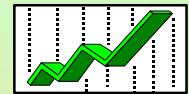
**Increasing use of supplier brochures by all primes**



# *Metrics Indicate Program Success*

- Process Escapes
- Lessons Learned
- Awareness Activity

Reported  
Quarterly to  
Program Manager

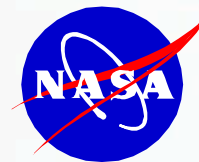


**Culture Change Requires Long-Term View**

# *We've Only Just Begun!*

## ***Continuing effort to:***

- Improve Processes***
- Implement Best Practices***
- Actively Use Lessons Learned***
- Communicate Awareness***



**PROCESS CONTROL**  
Mission Success Depends On You